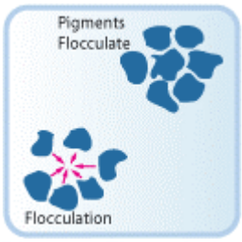
Dispersants

Why use Dispersants?

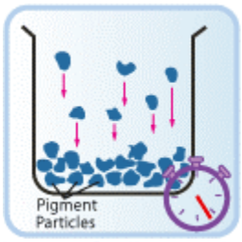
Pigment dispersants are used in paints & coatings to optimize **pigment dispersion** process and to **stabilize the pigment particles** during storage of the paint as well as during the film formation. The use of an efficient pigment dispersing agent is essential.

Traditionally, inorganic and polysaccharide based dispersants have widely used for the manufacture of dispersion paints. However, such products lack in paint film performance and often result in poor storage stability. This is why dispersing agents are most widely used.

In the following pages, the **benefits and features** of dispersing agents will be discussed, as well as **common issues solved** using such additives.



Pigment Flocculation



Pigment Sedimentation

Bénard Cells

Dispersing agents are used in a wide range of applications including decorative and industrial **waterborne** and **solventborne** coatings. In this Dispersing Agents Center, several markets will be described, with formulation guidelines for each one.

Benefits and Features :

In the manufacture of dispersion paints, **the pigments and extenders are to be properly dispersed** in the carrier phase. The degree of dispersion of the pigment and extender particles effects the major functions of the paint such as hiding power, color development, shelf-life, gloss etc.

The use of an efficient pigment dispersing agent is essential. The deflocculating effect of the pigment dispersing agent results, even during the incorporation of the pigment/extenders, in a strong reduction of the viscosity of the mill base. This optimizes loading level of pigments and extenders and the milling efficiency considerably.

The following benefits and features of dispersing agents will be discussed:

- Pigment Wetting
- Pigment Stability - Storage Stabilization
- Enhanced Gloss
- Uniform Color Appearance
- Hiding Power
- Color Strength
- Compatibility between Ingredients
- Grinding Time Reduction

Pigment Wetting :

Pigment wetting is the replacement of adsorbed air/water on the pigment surface with the liquid medium. Poor wetting causes incompatibility between the pigment dispersion and the base paint to cause rub (flooding).

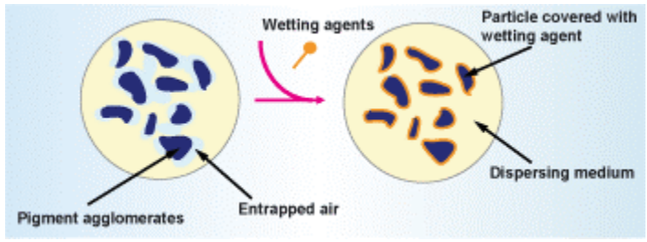
Surface tension/Wetting problem

2 min shaker

10 min shaker

This problem can be solved by adding a non-ionic dispersant to the base paint. Nonionic dispersants lower the difference in surface tension and act as a wetting agents: they displace air from the pigment surface and adsorb onto the surface. Being low molecular weight surfactants, they penetrate rapidly into pores, gaps and channels between the particles. This may result in a reduced size of the pigment agglomerates and aggregates (the compressed air causes an explosion of the agglomerated particle). Nevertheless a further mechanical breakdown of the particles will still be necessary.

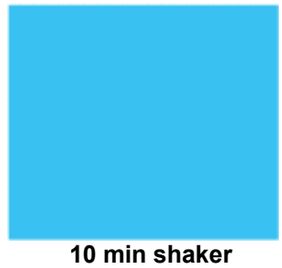
Pigments Wetting



NUOSPERSE® FN 265 is used in water-based paints, whereas NUOSPERSE® 2006 is used in water-based and solvent-based paints.

Wetting Problem
solved by adding Dispersants

2 min shaker



10 min shaker

The wetting problem is solved by the addition of NUOSPERSE® 2006 or NUOSPERSE® FN 265.

Pigment Stability- Storage Stabilization of Waterborne Paint :

With time, pigment particles tend to re-agglomerate and flocculate, causing sedimentation at storage.

Pigments Stability of a Water-based Coating

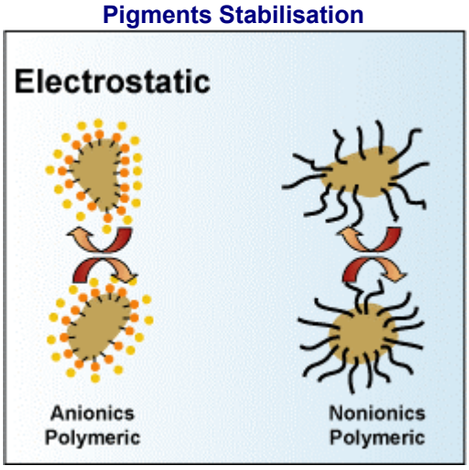
Dispersing agents act as stabilizers, avoiding re-agglomeration and flocculation of the dispersed pigment particles. Pigment stabilization follows 2 different mechanisms:

Ionic dispersants follow the electrostatic stabilization mechanism. This mechanism is based on establishing a charged double layer at the pigment particle/liquid interface, known as the DLVO-theory.

The charged ionic dispersant is primarily adsorbed onto the pigment surface, producing a charged layer with the immediate surrounding liquid and forming a diffused part of the double layer. When particles approach the diffused parts of the double layer, they begin to interpenetrate giving rise to strong Coulombic (electrostatic) repulsive forces.

Nonionic dispersants follow the steric stabilization mechanism. This mechanism is also known as the entropic stabilization mechanism. The barrier, formed by the adsorbed molecules onto the pigment surface, reduce the attractive forces between pigment particles.

Pigments Stabilisation



Recommended anionic polymeric dispersants to improve pigment stability:

NUOSPERSE® FX 504	Ammonium salt of Acrylic Polymer, 30% a.m.
NUOSPERSE® FX 605	Sodium salt of Acrylic Polymer, 45% a.m.
NUOSPERSE® FX 508	Ammonium salt of a modified Acrylic Polymer, 50% a.m.

Enhanced Gloss :

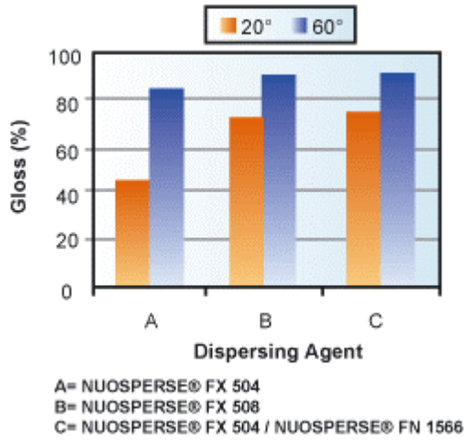
The gloss of a paint systems is influenced by the particle size. Poor resistance to flocculation or inadequate deagglomeration of the pigment particles result in poor gloss.

In water-borne coatings, polypropylene glycols or others are added to promote wet edge time. NUOSPERSE® FX 508 is designed for complete compatibility with the resins and glycols; resulting in the maximum gloss level. Traditional not modified acrylic based dispersants, like NUOSPERSE® FX 504 gives only desired gloss levels when they are combined with a nonionic wetting agent (e.g. NUOSPERSE® FN 1566).

Pigment dispersants strongly affect the gloss. It is extremely important that **the dispersant is completely compatible with the binder**. This minimizes flocculation during the film formation process, thus leading to optimal gloss.

NUOSPERSE® FX 508 and a combination of NUOSPERSE® FX 504 with wetting agent NUOSPERSE® FN 1566 provide good gloss to the paint. This is shown in the figure below.

Gloss of a Water-based Dispersion Paint (Polyacrylate)



The advantage of NUOSPERSE FX 508 above the combination NUOSPERSE FX 504/FN 1566 is lower foam formation and addition of one product in stead of two.

Uniform Color Appearance :

Color development is the generic designation of the color uniformity and quality of a tinted paint film. It is one of the main fundamental performance criteria of colorants.

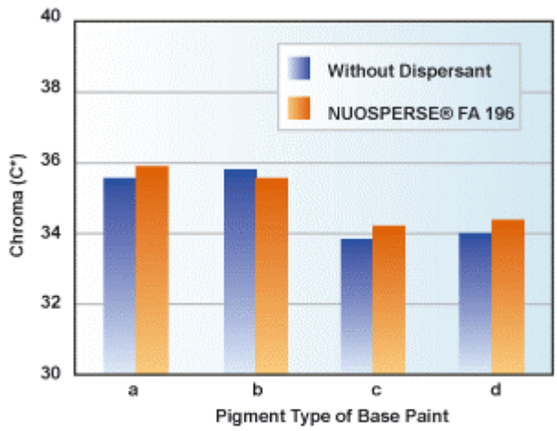
Good color development means that the **color appears in a uniform homogeneous manner** and at the expected strength. The complete development of color obtained from colorants has a vital bearing on the application properties and economics of the tinted coating formulations.

Color development in the base paints is related to a number of factors such as:

- colorant acceptance
- dispersion stability characteristics of the pigment in the colorant
- dispersion stability of the pigment in the base paint

After the incorporation of the universal colorant in a solventborne base paint, the color development properties are improved by NUOSPERSE® FA 196.

Color Development (Yellow Oxide Colorant)



a. Kronos 2065; stabilized with Al, Si, Zn
b. Kronos 2160; stabilized with Al, Si
c. Kronos 2190; stabilized with Al, Zr
d. Kronos 2310; stabilized with Al, Si, Zr

Hiding Power :

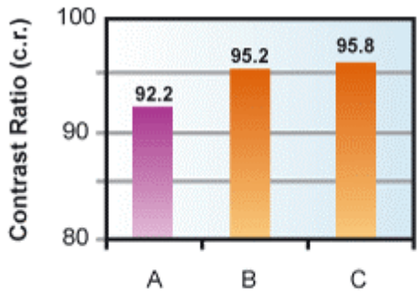
The hiding power of a coating is strongly influenced by the good dispersion of pigments in the binder media. The more the pigment particles agglomerate, the worse the hiding power becomes.

NUOSPERSE® dispersants increase the hiding power since they counteract pigment flocculation.

For solvent based systems, NUOSPERSE® 700 is the dispersant of choice for organic pigments, and NUOSPERSE® FA 196 for carbon black and inorganic pigments.

For industrial solvent based paints including stoving and 2-component systems, NUOSPERSE® FX 9086 and NUOSPERSE® FX 9085 are preferred.

Hiding power values in white long oil alkyd



A= without Dispersing Agent
B= with 0.5% NUOSPERSE® FA 601
C= with 0.5% NUOSPERSE® FA 196

Contrast Ratio c.r. = whiteness black surface / whiteness white surface X 100
Paint film is applied on hiding charts 100 micron wet

Color Strength :

Pigments dispersants, by suppressing pigment flocculation, allow an increase of color strength of the final paint.

For example, NUOSPERSE® 700 increases the color strength of color pigments, and gives to the pigments better color strength properties than soya lecithine.

The table below shows the positive effect of NUOSPERSE® FA 700 on the color strength of a paste based on Chinacridon violet.

Color Strength, Visual Judgement

	After 15 min	After 1 day	After 1 week	After 1 month
Pastel paint without dispersant	5	4	4	4
Pastel paint with NUOSPERSE® 700	10	10	10	10
Pastel paint with competition product (soya-lecithine)	7	5	5	4.5

1 = bad / 10 = excellent

After different storage periods, the mill base was mixed with the white paint, the color strength of the bases in both the competitor's product and the blank was reduced, whilst with NUOSPERSE® 700 this color strength remained constant.

Compatibility between Ingredients :

Ingredients of a coating (binder, pigments, colorant...) have to be compatible and mix properly. If not, this incompatibility causes poor emulsification, low color development, color droplets floating in solvent-based paints...

Colorant and Solvent-based Alkyd do not mix properly

Standard paint with colorant | Paint with 0.2% FA 196 mixed with colorant

To ensure a good color acceptance it is necessary to adapt the base paint to the universal colorant or the pigments. Dispersants such as NUOSPERSE® FA 115 and NUOSPERSE® FA 196 have shown their ability to improve the compatibility of color systems and water-based coatings, as well as in solvent-thinned coatings.

Thanks to dispersing agents, pigment concentrates are compatible with the following coating systems:

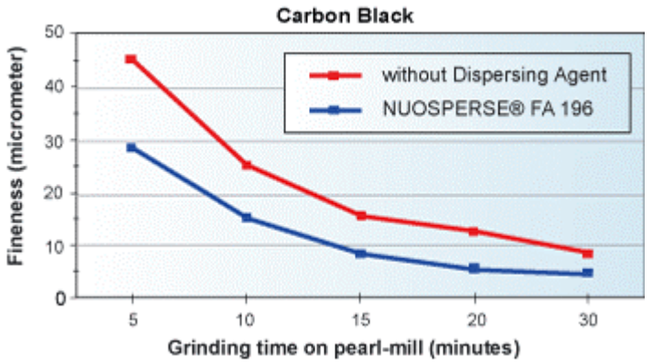
- Alkyds
- Alkyd-melamines
- Poly-urethanes
- Acrylics
- Epoxy-polyamide
- Polyester-based paints

Grinding Time Reduction :

Grinding is an important stage in the formulation of a coating. It is the breakdown of the pigment particles by mechanical shearing forces.

Using dispersing agents allows to reduce this grinding (or milling) time (see picture below). By reducing grinding, energy and 50% of the time can be saved.

Reduce Milling Time

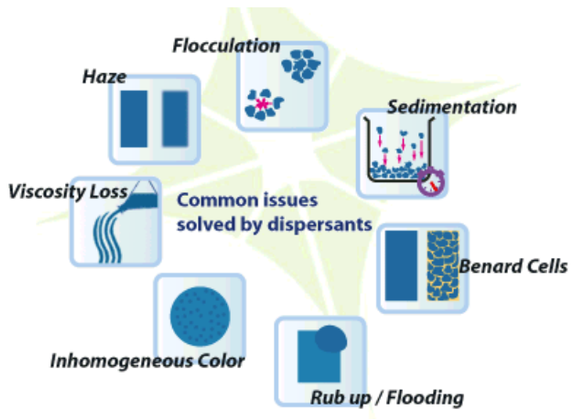


2 examples of dispersing agents to reduce grinding time :

- NUOSPERSE® FA 196
- NUOSPERSE® 700

Common Issues solved by Dispersants :

Dispersing agents are used to solve a wide range of common issues including:



Haze :

Hazy appearance is a result of to much scattering of the light beam in different directions.

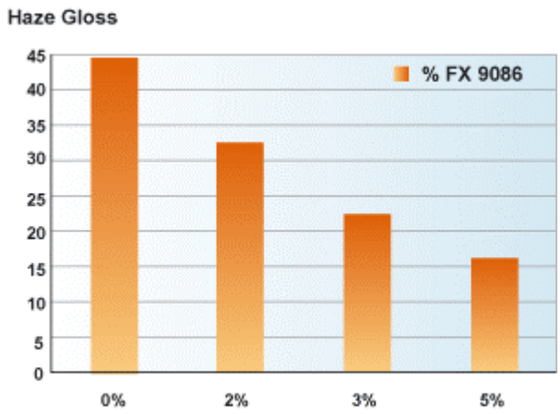
To reduce the hazy appearance, the particle size distribution of the pigments in the coating has to be considered. **A proper distribution of the pigment particles will reduce the hazy effect**.

NUOSPERSE® dispersing agents will improve the grinding conditions of the pigment particles resulting in optimum particle size distribution. Dispersing agents stabilize the pigment particles against reflocculation, and after storage the pigment distribution will not change.

In solvent-based OEM and car repair coatings, NUOSPERSE® FX 9086 will provide strong reduction of the hazy effect.

The effect of NUOSPERSE® FX 9086 on haze gloss in an Heliogene Blue-full tone car repair coating is represented in the picture below. Low value implicates less hazy appearance.

NUOSPERSE FX 9086: effect on haze gloss
in Heliogene Blue-fulltone car repair coating



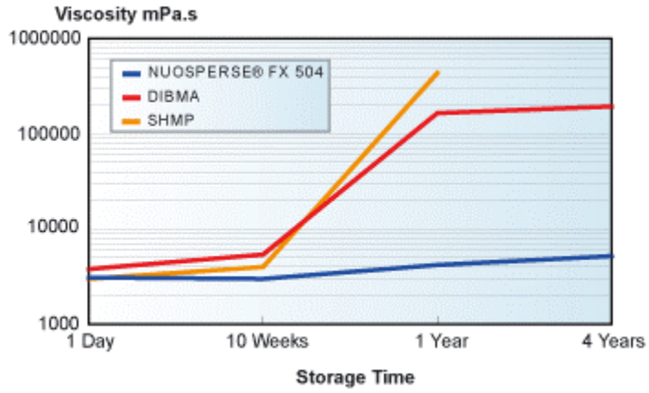
Pigment Flocculation :

During film formation in a waterborne paint, the film is gradually transferred from a highly polar medium into a low polar medium. The electrostatic stabilization is strongly reduced at this stage and may not sufficiently protect the particles from flocculation.

Steric stabilization achieved with nonionic dispersants will be the major mechanism, avoiding flocculation resulting in optimized properties such as gloss, color strength, film appearance as well as mechanical film properties.

A good indication for flocculation during storage of paint is an **increase in viscosity**. When viscosity increases after time, it is a strong sign that the dispersant is inadequate or that the level of dispersant is incorrect. Dispersing agents avoid flocculation and ensure a stable viscosity of the paint over time.

Dispersion Paint Stability System
Styrene acrylic PVC: 80% Dispersant: 0.3%

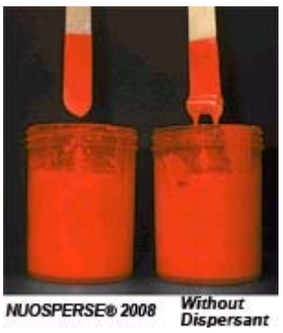


Pigment Sedimentation :

The degree of sedimentation is dependent upon low shear rate viscosity and the shape and size of the solid particles.

Dispersing agents decrease the average particle size of pigments and counteract flocculation, avoiding sedimentation. They ensure the paint manufacturer maximum storage stability.

Pigments Sedimentation



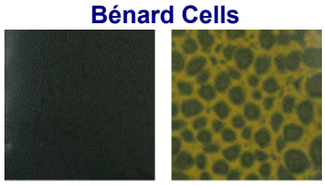
3 examples of dispersing agents to avoid pigment sedimentation in solvent-based coatings:

- NUOSPERSE® 700
- NUOSPERSE® 2008
- NUOSPERSE® FX 9086

Floating / Bénard Cells :

The difference in pigment mobility during drying of solvent borne paints induce **floating** of pigments and creation of Bénard cells.

Bénard Cells



0.4 MM DFT 4 MM DFT

Since dispersants increase the color development of pigments, the formation of flooding and floating in the paint film is reduced.

One example of dispersing agent to suppress Bénard cells:

NUOSPERSE® FA 196

Rub up / Flooding :

Flooding is the result of surfactant drift, i.e. when the surfactant is leaving the pigment surface area after the dispersion is mixed in the paint system

Surfactant Drift => Rub Problem

2 min shaker **10 min shaker**

The best solution to avoid rub-up and flooding in waterborne systems is to use low molecular weight anionic dispersants, as they impart long term stability. Rub-up problems can be solved by adding 0.2% of NUOSPERSE® FA 115 to the base paint.

Rub Up Problem
solved by adding Dispersants

2 min shaker **10 min shaker**

Recommended dispersing agents to suppress pigment flooding:
Waterborne base paints
NUOSPERSE® FA 115

Solventborne base paints
NUOSPERSE® FA 196

Inhomogeneous Color :

Color development is the generic designation of the color uniformity and quality of a tinted paint film. Good color development means that the color appears in a uniform homogeneous manner and at the expected strength. The complete development of color obtained from colorants has a vital bearing on the application properties and economics of the tinted coating formulations.

Regarding the application of universal colorants in solvent borne systems, first the **emulsification of the colorant into the solvent medium** has to be considered. As the continuous phase of the universal colorant is polar (typically water/glycol) and the solvent borne paint non-polar (mineral spirits), care should be taken both systems mix well one with the other.

In various practical cases this is insufficiently reached, leading to inhomogeneous emulsions of colorant particles into the solvent-based base paint.

Colorant and solvent-based alkyd do not mix properly

Standard paint with colorant | Paint with 0.2% FA 196 mixed with colorant

A next priority is the **size of the colorant particles** in the solvent-based base paint. Different from what is noticed in water-based paints, the pigment particles in the colorant are - during the first stage after addition - still surrounded by the "colorant medium". During mixing, the size of the droplets is reduced and finally the pigment particles dispersed directly into the solvent-based base paint.

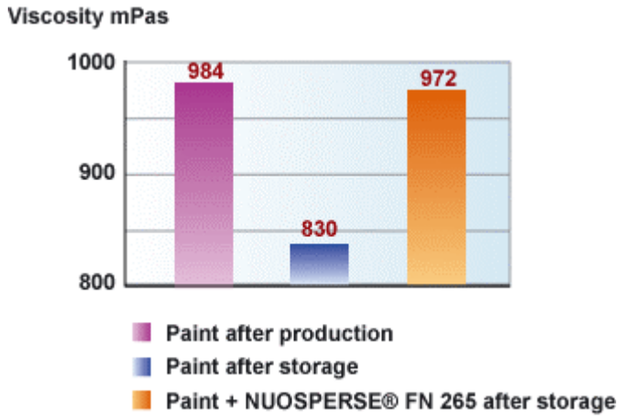
Viscosity Loss :

Dispersion paints often loss viscosity after storage of the paint. In extreme cases this can lead to failure of the paint as too low viscosity leads to sedimentation of the pigment/filler particles.

A possible reason of viscosity loss is the **insufficient stabilization of the pigment and filler particles after storage**. A not proper stabilization can result in flocculation.

When a system is thickened with an associative thickener, flocculation of the particles leads to disturbing of the thickening structure resulting in drop of viscosity. A more stable system will be obtained when the particles are stabilized with a combination of charge and steric stabilization. Addition of a non ionic dispersing agent like NUOSPERSE® FN 265 stabilize the pigment particles, resulting in a more stable system are storage.

Viscosity of an Acrylic Dispersion Paint



Water based Applications :

Architectural Coatings :

In both interior and exterior architectural coatings the choice of the dispersing agent is a key thing to get optimum color development and product stability. In the table below you will find specific product recommendation for your water- based decorative paints

Starting point formulation for a waterbased architectural coating
Pure Acrylic Topcoat (monocoat)

Recommended Dispersants	Product	% Use	Characteristics
Pigment Wetting Anti-Floating	NUOSPERSE® FX 504	0.1 - 0.8	Cost effective wetting and dispersant package. NUOSPERSE FX 504 for hydrophilic pigments and extenders. NUOSPERSE FN 1566 for improved paint stability. This product also improves freeze-thaw stability.
	NUOSPERSE® FN1566	0.1 - 0.6	
	NUOSPERSE® FN 211	0.1 - 0.6	
	NUOSPERSE® FX 605	0.1 - 0.7	Wetting and dispersant package for APE-free and low odor formulations. NUOSPERSE FX 605 for hydrophilic pigments and extenders. NUOSPERSE FN 265 for excellent pigment wetting and stabilization.
	NUOSPERSE® FN 265	0.1 - 0.5	
Flow Leveling Substrate Wetting	NUOSPERSE® 2006	0.1 - 0.5	Solvent free interfacial tension modifier. Optimising substrate wetting. Reducing floatation and flooding.

Other Ingredients:

Binder	**Acrylic Emulsion**	**20 - 40**
Fillers & Extender	**Tio2, CaCO3**	**5 - 10**
Corrosion Inhibitor	NALZIN® FA 179	0.1 - 0.5
Foam Suppressor	DAPRO® DF 7005	0.2 - 0.6
	DAPRO® DF 7010	0.2 - 0.5
Coalescing Agent	DAPRO® FX 510	0.3 - 2.5
	DAPRO® FX 511	0.2 - 2.0
Rheology Modifier	RHEOLATE® 244	0.4 - 3.0
	RHEOLATE® 425	0.2 - 0.8
	RHEOLATE® 450	0.3 - 1.0
	RHEOLATE® 278	0.4 - 3.0
	RHEOLATE® 210	
Colorant System	TINT-AYD® WCH	
	TINT-AYD® IPC	

Automotive Coatings :

In automotive OEM coatings, the type of dispersant used strongly impact the stability of the pigment dispersion and thus the film properties, appearance and durability of the coatings. In the table below you will find specific product recommendation for your water-based automotive refinish coatings.

Starting point formulation for a waterbased automotive coating
Acrylic Basecoat (metallic)

Recommended Dispersants	**Product**	**% Use**	**Characteristics**
Pigment Wetting Anti-Floating	NUOSPERSE® FX 365	0.2 - 1.0	Nonionic, polymeric wetting and dispersing agent. First choice for organic pigments. Low foaming.
	NUOSPERSE® FX 600	0.2 - 2.0	Polymeric dispersing agent. Excellent pigment dispersion and stabilisation, first choice for inorganic and hydrophilic pigments. Extremely low foaming.

Other Ingredients :

Binder	*Acrylic emulsion*	
Foam Suppressor	DAPRO® DF 1760	0.2 - 0.6
	DAPRO® DF 880	0.05 - 0.2
	DAPRO® DF 900	0.05 - 0.2
Rheology Modifier	BENTONE® HD	0.3 - 1.0
	RHEOLATE® 205	0.1 - 2.0
	RHEOLATE® 125	0.2 - 0.75
Colorant System	TINT-AYD® CW	

Car Refinish & Commercial Vehicles :

In automotive refinishing, the type of dispersant used strongly impact the stability of the pigment dispersion and thus the film properties, appearance and durability of the coatings. In the table below you will find specific product recommendation for your water-based automotive coatings.

Starting point formulation for a waterbased automotive refinish coating
Acrylic Basecoat

Recommended Dispersants	Product	% Use	Characteristics
Pigment Wetting Anti-Floating	NUOSPERSE® FX 365	0.2 - 1.0	Nonionic, polymeric wetting and dispersing agent. First choice for organic pigments. Low foaming.
	NUOSPERSE® FX 600	0.2 - 2.0	Polymeric dispersing agent. Excellent pigment dispersion and stabilisation, first choice for inorganic and hydrophilic pigments. Extremely low foaming.

Other Ingredients :

Binder	Acrylic	
Foam Suppressor	DAPRO® DF 1760	0.2 - 0.6
	DAPRO® DF 900	0.05 - 0.2
Rheology Modifier	BENTONE® HD	0.3 - 1.0
	RHEOLATE® 125	0.2 - 0.75
Colorant System	TINT-AYD® CW	

Marine & Protective Coatings :

In marine and protective application, the paint film should protect the substrate from aggressive elements. The dispersant should be carefully chosen in order to have no negative impact on the water resistance and salt spray properties of the coating. In the table below you will find specific product recommendation for your water-based protective coatings.

Starting point formulation for a waterbased protective coating
Single Pack Alkyd Emulsion Topcoat

Recommended Dispersants	Product	% Use	Characteristics
Pigment Wetting Anti-Floating	NUOSPERSE® FX 365	0.2 - 1.0	Nonionic, polymeric wetting and dispersing agent. First choice for organic pigments. Low foaming.
	NUOSPERSE® FX 600	0.2 - 2.0	Polymeric dispersing agent. Excellent pigment dispersion and stabilisation, first choice for inorganic and hydrophilic pigments. Extremely low foaming.

Other Ingredients :

Binder	*Alkyd Emulsion*	
Flow Leveling Substrate Wetting	DAPRO® W 77	0.25 - 1.0
Foam Suppressor	DAPRO® DF 1181	0.05 - 0.2
	DAPRO® DF 2162	0.2 - 0.3
UV Stabilizer	DAPRO® UVCW 30	1.2 - 2.2
	TINT-AYD® CW 5499	
Surface Conditioner	SLIP-AYD® SL 295	1.0 - 4.0
	SLIP-AYD® SL 4709	0.1 - 0.5
Rheology Modifier	BENTONE® EW	0.3 - 1.0
	RHEOLATE® 212	0.2 - 2.0
Drier	DAPRO® 7007	0.5 - 0.7 (on vehicle)
Colorant System	TINT-AYD® CW	

Appliance & Metal Furniture Coatings :

In the table below you will find specific product recommendation for your metal furniture coatings.

Starting point formulation for a waterbased appliance and metal furniture coating

Acrylic Baking Enamel

Recommended Dispersants	**Product**	**% Use**	**Characteristics**
Pigment Wetting Anti-Floating	NUOSPERSE® FX 365	0.2 - 1.0	Nonionic. polymeric wetting and dispersing agent. First choice for organic pigments. Low foaming.
	NUOSPERSE® FX 600	0.2 - 2.0	Polymeric dispersing agent. Excellent pigment dispersion and stabilisation, first choice for inorganic and hydrophilic pigments. Extremely low foaming.

Other Ingredients :

Binder	Acrylic	
Flow Leveling Substrate Wetting	DAPRO® W 77	0.25 - 1.0
Foam Suppressor Defoamer. Air Release	DAPRO® DF 1181	0.05 - 0.2
	DAPRO® DF 900	0.2 - 0.3
UV Stabilizer	DAPRO® UVCW 30	1.2 - 2.2
Matting Agent	DAPRO® FA W 34	5.0 - 15.0
Surface Conditioner	SLIP-AYD® SL 640	0.25 - 1.25
	SLIP-AYD® SL 18	0.5 - 3.0
	SLIP-AYD® SL 295	1.0 - 4.0
Rheology Modifier	RHEOLATE® 266	0.2 - 2.5
Colorant System	TINT-AYD® NV	
	TINT-AYD® CW	

Wood Coatings :

In the table below you will find specific product recommendation for your wood coatings.

Starting point formulation for a waterbased wood furniture coating
Acrylic or Polyester Emulsion - Primer/Sealer

Recommended Dispersants	Product	% Use	Characteristics
Pigment Wetting Anti-Floating	NUOSPERSE® FX 365	0.2 - 1.0	Nonionic, polymeric wetting and dispersing agent. First choice for organic pigments. Low foaming.
	NUOSPERSE® FX 600	0.2 - 2.0	Polymeric dispersing agent. Excellent pigment dispersion and stabilisation, first choice for inorganic and hydrophilic pigments. Extremely low foaming.

Other Ingredients :

Binder	*Acrylic or Polyester Emulsion*	
Flow Leveling Substrate Wetting	DAPRO® W 77	0.25 - 1.0
Foam Suppressor	DAPRO® DF 1760	0.2 - 0.6
	DAPRO® DF 7005	0.2 - 0.6
Rheology Modifier	RHEOLATE® 266	0.2 - 2.0

Road Marking Coatings :

In the table below you will find specific product recommendation for your traffic paints.

Starting point formulation for a waterbased traffic coating
Acrylic Resin

Recommended Dispersants	Product	% Use	Characteristics
Pigment Wetting Anti-Floating	NUOSPERSE® FX 504	0.1 - 0.8	Dispersing agent for hydrophilic pigments, like TiO2 as well as extenders; no foaming, for excellent paint stability.
	NUOSPERSE® FN 211	0.1 - 0.5	Low foaming pigment wetting agent. APE-free. Excellent wetting for hydrophobic extenders.

Other Ingredients :

Binder	*Acrylic emulsion*	
Foam Suppressor	DAPRO® DF 7010	0.2 - 0.5
Surface Conditioner	SLIP-AYD® SL 1618	0.1 - 0.5
Coalescing Agent	DAPRO® FX 511	0.4 - 2.5
Rheology Modifier	BENAQUA® 4000	0.3 - 2.0
	RHEOLATE® 310	0.1 - 0.5

Other Areas of Application :

Agricultural and Industrial Equipments
Can Coatings
Coil Coatings

Solvent Based Applications :

- Architectural Coatings
- Automotive Coatings
- Car Refinish & Commercial Vehicles
- Marine and Protective Coatings
- Appliance and Metal
- Furniture Coatings
- UV Wood Coatings
- Agricultural and Industrial Equipment
- Can Coatings
- Coil Coatings
- Road Marking Coatings

Families of Dispersants :

- Polyacrylates (Sodium / Ammonium)
- Polycarboxylates
- Phosphate Esters
- Soya Lecithin Modified Polymers
- Polyglycolethers
- Sulphoscuccinates
- Sulphonates
- Fatty Acid Derivatives
- Phosphate Ester Modified Polymers

Performance Datasheets for the following problems :

- How to solve colour acceptance problems – Surfactant drift
- How to solve colour acceptance problems – bad wetting
- How to get a low foaming pigment dispersion
- Odour Restriction – New Dispersing Solution
- Pigment dispersion in economical decorative paint
- How to avoid viscosity loss during storage
- Haze Gloss Issue

For answers to the above, check at the following source :

http://www.specialchem4coatings.com/tc/dispersants/index.aspx?id=performance

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Source :

http://www.specialchem4coatings.com/tc/dispersants/index.aspx?lr=wpc0530&li=15208